

國立成功大學
110學年度碩士班招生考試試題

編 號： 71

系 所： 機械工程學系

科 目： 工程數學

日 期： 0202

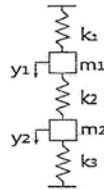
節 次： 第 3 節

備 註： 不可使用計算機

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Solve $x^2 y'' - 5xy' + 8y = x^3 + x^2 \ln x$; $y(0) = 0, y'(0) = 0$ (15%)

2. Find the displacements of $y_1(t)$ and $y_2(t)$ at any given time t for the system given below, having $m_1 = m_2 = 2$; $k_1 = 1; k_2 = 2; k_3 = 3$, with initial conditions of $y_1(0) = y_2(0) = 0, y_1'(0) = y_2'(0) = 1$ by using the method of diagonalization of matrices. (15%)

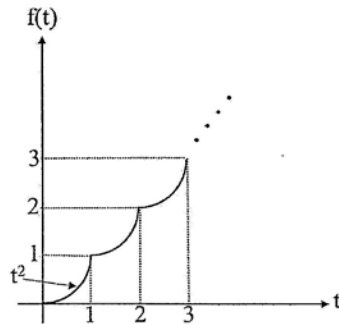


3. Prove the equation of continuity for compressible and incompressible fluids. (20%)

$$\frac{\partial \rho}{\partial t} + \text{div}(\rho v) = 0 \quad (\text{compressible})$$

$$\text{div}(v) = 0 \quad (\text{incompressible})$$

4. Find the Laplace transformation of the following function. (15%)



5. Find the Fourier series of the function shown as following, then solve the following series (15%)

$$f(x) = x; \quad (-2 < x < 2) \text{ and } f(x) = f(x+4)$$

(a) $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} \dots = ?$

(b) To use Parseval's theorem to find $1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots = ?$

6. To evaluate (a) $\oint_C \frac{\cos(z\pi)}{(z-4)(z-1)} dz$, where C is the $|z| = 4$.

(20%)

(b) the integral $\oint_C [z^2 - \operatorname{Im}(z)] dz$ along the path C where is the square with vertices at $(0,0)$, $(0, -i)$, $(1,-i)$, $(1,0)$.